Fish & Wildlife Division

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Prairie Rattlesnake (*Crotalus viridis viridis*) Monitoring in Alberta – Preliminary Investigations (2000)

Alberta Species at Risk Report No. 28

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

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Prairie Rattlesnake (*Crotalus viridis viridis*) Monitoring in Alberta – Preliminary Investigations (2000)

Selwyn L. Rose

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I would also like to thank Kevin Isles for his assistance with fieldwork.

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This project was completed when the Fish and Wildlife Division was part of Alberta Environment; this division is now part of Alberta Sustainable Resource Development.

EXECUTIVE SUMMARY

In the fall of 2000, a project was undertaken to collect and review information on the over-wintering sites used by the prairie rattlesnake (*Crotalus viridis viridis*) in Alberta. These sites, known as hibernacula, and the surrounding suitable habitat, are undoubtedly important limiting factors affecting rattlesnake distribution within Alberta. This report summarises the preliminary work completed to begin updating historical information on the prairie rattlesnake, and includes suggestions for a long-term monitoring and population analysis program. Information gained from this project is intended to help in the protection and survival of this species in Alberta.

A data file was prepared that included historical information found in the provincial Biodiversity/Species Observation Database (BSOD), new information from recent research projects within the province and any successful searches during the fall for new hibernacula. Known hibernacula and prairie rattlesnake observation locations have been plotted on 1:50,000 scale maps, suitable for field use, along with a 1:350,000 scale regional overview map. These maps will provide background information, help enable all known data to be updated and allow for the addition of new information as fieldwork is completed.

Ground searches were undertaken to locate ten previously recorded hibernaculum sites in areas along the Oldman, South Saskatchewan and Bow Rivers. These searches had limited success as problems arose from using non-standardized data and vague site descriptions to locate historical den sites. Of the ten areas searched, only four hibernacula were located. Rattlesnake activity was noted at only two of those sites. Two additional hibernacula were located and snake activity was noted while conducting these searches. A complete review of all sites was not possible during the short, first field season. In an effort to begin updating the status of this species, current information from other recent rattlesnake studies in areas along the Red Deer, South Saskatchewan and Oldman river valleys has been included in this report.

Suggestions for a long-term population monitoring and analysis program include using a standardized observational monitoring program or a more intensive population analysis at representative sites in the province. Data (such as the presence or absence of snakes and/or snake counts at particular hibernacula) may be collected annually over a 4 or 5 year period (baseline information) then less frequently. Population estimates and characteristics may then be extrapolated from the results and monitored over time.

Future research on the prairie rattlesnake should concentrate on gathering standardized, long-term information about hibernaculum sites and rattlesnake activity. Remote sensing and land stratification techniques may be used to help locate hibernacula and birthing rookeries. Standardized information on historical and new hibernaculum sites, including population estimates and distribution, will enable more accurate determination of species status and aid in the management of prairie rattlesnakes in Alberta.

1.0 INTRODUCTION

The prairie rattlesnake (*Crotalus viridis viridis*), a sub-species of the western rattlesnake (*Crotalus viridis)*, reaches the northern limit of its North American range in southern Alberta (MacArtney and Weichel 1989). The prairie rattlesnake is distributed along the major river drainages in the southeastern portion of the province (Cottonwood Consultants 1987, Gannon 1978, Pendlebury 1977), and observations have been made along portions of the Red Deer, Bow, South Saskatchewan, Milk and Oldman Rivers.

In 1997, Watson and Russell reported that there was enough anecdotal information to suggest that the distribution and abundance of prairie rattlesnake had declined in Alberta. Historical records indicate that the prairie rattlesnake had a wider distribution prior to the late 1970s than at present (Cottonwood Consultants 1986, Pendlebury 1977, Russell and Bauer 1993). Larry Powell of the University of Calgary suggests that the number of snakes is declining and that migration routes may be disrupted, thus halting gene flow (L. Powell, pers. comm.). Powell believes that this may have adverse affects upon populations and suggests that more formal investigation into these issues is needed.

To date, no intensive search for suitable hibernacula or documentation of population numbers has been carried out. The data currently available regarding population numbers in Alberta cannot be used alone to estimate the total provincial population of prairie rattlesnakes as the data are not standardized and were not collected over a sufficiently long time frame (Rice 2000). The prairie rattlesnake is considered *May Be At Risk* in Alberta (Alberta Sustainable Resource Development 2001), although the information found from short-term research projects and occasional sightings may be too limited to clearly define their status. This is reflected by the recent assessment of the Alberta Endangered Species Conservation Committee that the prairie rattlesnake is *Data Deficient* (Endangered Species Conservation Committee 2000). There were not enough data available for the committee to use the IUCN (International Union for the Conservation of Nature) criteria to determine the status of this species.

The goal of this preliminary study was to begin updating historical information on prairie rattlesnake hibernacula locations and activity, and to add any new information discovered during fieldwork. This information may then be used to determine representative study sites for monitoring projects for the prairie rattlesnake. Monitoring this species will facilitate greater accuracy in estimating population numbers and trend and determining its distribution in Alberta. This will ultimately result in better management actions for this species in Alberta.

2.0 STUDY AREA

The study area for this project consisted of the previously known range of the prairie rattlesnake within Alberta. The locations of specific hibernacula along the eastern portions of the Oldman River Valley, near the confluence of the Oldman and Bow Rivers, and along the western portion of the South Saskatchewan River were obtained from the Biodiversity/Species Observation Database (BSOD).

Data from other research projects were obtained for areas along the Red Deer River, the Old Man River near Lethbridge and an area on the South Saskatchewan River, north of Medicine Hat.

The habitat in the study area is typically mixed-grass prairie within the Grassland Natural Region. The prairie rattlesnake is often found in river valleys and associated coulees, including badlands, sage flats and surrounding short-grass prairie. These river valleys often provide the necessary conditions for hibernacula, and include slump blocks, abandoned burrows, erosion channels and rocky outcrops.

In order to avoid any duplication of field work, an effort was made to search areas where studies have not been completed recently. As well, an effort was made to search some areas where previous data or research did not exist.

3.0 METHODS

The first step in this project was to review previous records and interview researchers who had recently completed projects on the prairie rattlesnake in Alberta. A summary of this research has been included in Appendix 1. The author and a field assistant then completed ground searches to obtain current information on ten hibernacula selected from BSOD records. These sites were not within any of the recent research areas. During ground searches for the ten hibernacula, the co-ordinates of each site were established, and if the hibernaculum was not observed, a search of the surrounding area was undertaken. To search for potential hibernacula, mammal burrows, slump fissures, erosion channels, and rocky crevices were targeted and inspected for snake activity. The location attempt was considered unsuccessful if a search of approximately one to two square kilometres was completed without observations of potential hibernacula. During the search for historical hibernacula, an active search for new sites in the area was also performed.

Information contained in previous records, recent research and any current findings was used to determine the distribution of this species in Alberta. Base maps were produced showing rattlesnake observation records and hibernaculum locations.

4.0 RESULTS

In total, 96 prairie rattlesnake hibernaculum sites and 455 prairie rattlesnake observation records have been mapped and placed in a data file. The hibernaculum sites include eighty-nine sites already listed in BSOD. Fifteen of these sites along the Red Deer River valley were visited by Fish and Wildlife Division biologists, and current data on these sites has been added to the file. Current data is still required for a number of the other hibernacula listed in BSOD. An effort was made to group duplicated historical sites together in the new file. Two new hibernacula were located on the Oldman River valley, where snake activity was observed while searching for the ten sites selected from BSOD. Searches for the ten hibernaculum sites were conducted along the South Saskatchewan, Oldman, Bow and Milk River valleys, to confirm recent snake activity.

Five new active hibernacula from the South Saskatchewan River valley, found during the recent Medicine Hat area project, have also been added to the data file (totalling 96 hibernaculum sites).

Four hundred and seven existing BSOD observation records of prairie rattlesnakes and forty-eight new observation records, including those made in the Medicine Hat, Brooks and Lethbridge study areas and observations made through this project, have been mapped and added to the data file (totalling 455 Observation Records).

All historical and current location data have been converted to NAD27 UTM co-ordinates for mapping. As data concerning the location of prairie rattlesnake hibernaculum sites are considered sensitive, all updated information has been stored on computer disks and made available to be entered into the Alberta Biodiversity/Species Observation Database.

5.0 DISCUSSION

A complete report on all active hibernacula in Alberta is not available because additional fieldwork will be necessary to obtain data for all sites.

Future research on the prairie rattlesnake should concentrate on gathering standardized, long-term data in order to develop an appropriate management program for this species. Provincial co-ordination of research projects and databases should be initiated to help increase our knowledge of snake distribution and population numbers throughout Alberta. These projects should include the compilation of provincial base maps and updating data on active and in-active hibernacula, birthing rookeries, observations and road mortality.

Ground searches to locate previously recorded hibernaculum sites along the Oldman, South Saskatchewan and Bow Rivers were of limited success. Much of this was due to problems associated with using non-standardized data and vague site descriptions. A systematic process of evaluating and documenting information from previous records and new data should be initiated. Use of a standardized data sheet for recording observations would help correct this problem. Other barriers were encountered because of local ranchers' reluctance to reveal information on the locations of hibernacula. Anecdotal information suggests that ranchers fear that they may lose their land to conservation projects. Any future research will have to address this concern. As the locations of hibernacula are very sensitive data, it was also found that data were not easily obtained from other institutions or organizations.

6.0 MANAGEMENT IMPLICATIONS AND FUTURE DIRECTIONS

6.1 Recommended Program

6.1.1 Future Research

As the number of snakes observed during the fall mapping project and anecdotal information seem to indicate small population sizes, it is recommended that hibernaculum sites be monitored to collect information on population abundance and trends. Rattlesnake hibernacula from a variety of habitats, geographic locations and activity or disturbance levels may be selected for monitoring, to conduct population studies using standardized observation techniques or a mark and recapture program.

A continued effort should be made to record any road-killed snakes in heavy-use or non-protected areas. Suitable road-killed specimens should be kept for other research opportunities such as analysis of stomach contents. Oil and gas exploration, well servicing and related work has increased the amount of traffic on local roads in some parts of prairie rattlesnake range in Alberta. Areas with high mortality caused by motor vehicles should be targeted for the investigation of methods to reduce this mortality factor. Possible approaches for reducing snake road kills include lower speed limits, information signage, snake and small animal underpasses at selected sites, and public education and awareness programs.

The possibility of imposing development and vehicle travel restrictions in areas of identified critical habitat should be considered in future management plans for the prairie rattlesnake. Any negative events in these key areas may affect the local populations considerably. Seasonal travel restrictions for motor vehicles should be put in place to protect snakes migrating to and from hibernacula, and should include areas used as rookeries or birthing dens. These smaller and often inconspicuous birthing dens can be located a considerable distance from the main hibernaculum. A ground survey for hibernacula and rookeries should be conducted before any development occurs within critical habitat areas.

6.1.2 Other Areas of Future Study

Remote sensing techniques to determine the probability of finding hibernacula in a given area should be applied to the entire southern portion of the province. This technique, used along with ground searches, can be successful in finding new hibernacula (Nicholson and Rose 2001). This information will aid in the management of prairie rattlesnakes, as data collected at new hibernacula will permit more accurate evaluation of species status, estimate of population size and distribution in the province. The methods used to determine the probability of finding hibernacula could possibly be adapted for use in locating birthing rookeries.

Research to examine the effects of cattle grazing and agriculture on populations of snakes, and ways to improve agricultural practices, would also be helpful. Disturbance to the riverbanks by cattle may be interfering with potential hibernacula sites on the slump zone within terrace micro-sites. Potential and known hibernaculum sites can be assessed for erosion damage and reduced vegetation cover due to grazing by cattle. Agriculture practices may also be affecting populations

of rodents and other small animals on which the snakes depend for maintaining a supply of burrows or use as prey.

6.2 Monitoring Program Design

6.2.1 Recommended Program: Observational Study

A standardized observational study is recommended in which several hibernaculum sites be monitored within representative study areas during spring egress and fall ingress. One primary researcher and a field assistant would conduct the surveys at selected sites, alternating observation days at each study area to accommodate time spent travelling.

Standards would be incorporated for gathering data on snake population size and other characteristics at the hibernaculum. These standards may include the method and timing of surveys (seasonal and daily observation periods), acceptable weather and temperature conditions and geographic information system (GIS) information. Data would be recorded only on individuals found within a pre-determined range of the hibernaculum.

Once snakes have dispersed from their hibernacula, supplemental surveys can be made throughout the summer. These surveys would also be standardized (use established transects and a consistent method and timing of searching). Areas near the hibernacula with possible birthing rookeries may be surveyed, and upland areas may be searched for snakes that have dispersed. The number of snakes encountered (both live and road-killed) and snake behaviour should be recorded. Searches for new hibernacula can also be conducted during this summer period and confirmed during fall ingress periods.

6.2.2 Site Selection

At least three study areas should be used to report on the status of Alberta's prairie rattlesnake populations. Variations in population stability means that intensive surveys are needed at more than one site in order to acquire a representative sample (Watson and Russell 1997). Several active hibernacula may be chosen within each study area at which to make observations and to acquire population information.

Areas selected for study should be representative of the habitats in which the prairie rattlesnake occurs in southern Alberta, and cover the range of associated human activity. Sites should be chosen to give a sample of both positive and negative human effects on the rattlesnake. These may include sites found within protected areas, sites subject to many anthropogenic activities, and sites in more remote or undisturbed areas. Sites may be chosen from known hibernacula within appropriate geographical areas. For example, hibernacula found north of Medicine Hat along the east side of the South Saskatchewan River, occur where human activities include development of oil and gas resources, agriculture and ranching, and a moderate amount of recreational use. Hibernacula found within Alberta's provincial parks would be representative of protected areas, and sites found on remote private land could be chosen as sites subject to little disturbance.

6.2.3 Alternative Study: More Intensive Monitoring

A minimum of two study areas would be selected for a more intensive population analysis using mark-recapture study techniques. Although this type of investigation would require greater manpower and funding commitments, more information on population characteristics would be obtained. The study areas would include hibernaculum sites found in protected areas as well as hibernaculum sites found in multiple-use areas.

Selected hibernacula within each study area may be set up with drift fences and funnel traps to catch snakes emerging in the spring. Snakes would be implanted with microchips. A hand-held scanner could then be used to identify snakes that are recaptured during summer searches, and subsequent trapping periods at fall and spring congregations.

Stark (1985) provides examples of trap designs, and describes a simple, effective capture technique using black plastic tubing running from the entrances of prairie rattlesnake hibernacula. Larger hibernacula may require the use of both drift fences and funnel traps. Trap design will have to consider the safety of field workers and the general public by using fibreglass windows in trap boxes so that the snakes are visible to fieldworkers, installing warnings and possibly locks to protect the public.

Captured snakes should be measured (snout-to-vent length; SVL), sexed, marked and released near the capture site. Probing techniques can be used for sexing larger snakes, and the technique of applying pressure to evert the hemipenes may be used in sexing smaller snakes. In male rattlesnakes (*Crotalus viridis*), the hemipenes usually evert in both neonates and large adults when the tail is pulled slightly (Gregory 1983). All snakes of sufficient size (> 40 cm SVL) should be marked with a Passive Integrated Transponder (PIT) tag, which is injected dorsally on the left side, approximately 4 cm before the base of the tail (Powell *et al.* 1997). A scale-clipping method of permanently marking snakes would be appropriate for smaller snakes. Brown (1976) describes a scale-clipping system that involves clipping ventrals rather than sub-caudals, and a serial enumeration system.

Intensive monitoring of two representative study areas will require a team of two people for each area and a primary field researcher to co-ordinate the project. Trap set-up, trap monitoring and snake handling would require a minimum of two people at each site for safety concerns. Traps would have to be checked daily and possibly twice daily on days of extreme heat, cold or rain. Standardized transect searches could be carried out during the summer after spring congregations of snakes have dispersed. Any snakes observed should be caught and processed. The primary researcher and field assistants could also conduct ground searches for new hibernacula and rookeries. New data from active and non-active hibernacula, snake observations, and road mortality would be collected and entered into BSOD.

6.2.4 Treatment of Monitoring Program Results

Data should be collected over a five-year period as part of the observational study or the more intense mark-recapture study. The data collected each spring and fall, along with supplemental summer data, may be compared annually and used to detect any change in

abundance or trends in local populations during the study. In addition, as hibernacula data are updated, it may be possible to extrapolate population numbers for the province. Data collected in a monitoring study would increase our knowledge of critical habitat requirements and population trends for the prairie rattlesnake and can be used to improve management of this species in Alberta.

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Appendix 1. Review of Recent Prairie Rattlesnake Research in Alberta

Medicine Hat Area (Larry Powell, 1997, University of Calgary)

A multiple use area north of Medicine Hat was chosen for a multi-year radiotelemetry study of the movement and habitat use of the prairie rattlesnake. This study accompanied an extensive long-term mark-recapture study in the same area, and an examination of habitat requirements and hibernaculum locations (Powell *et al.* 1997). A preliminary paper was written for the Alberta Conservation Association to report on the techniques and findings of the first field season. Data were obtained on rattlesnake hibernaculum locations, movements, habitat use, and characteristics of the local population. The study did not continue in the next field season due to funding problems therefore estimates of population size, density and trends are not available. Data gained from the study on snake distribution, habitat use, and distribution of hibernacula are suitable for initial GIS-based analysis to be used in management programs (Powell *et al.* 1997).

Medicine Hat Area (Selwyn Rose 2000, Alberta Fish and Wildlife Division)

Previous work completed by Wolfe and Watke (1997) described the probability of finding prairie rattlesnake hibernacula in an area north of Medicine Hat using remote sensing and land stratification techniques. The primary purpose of the study undertaken in August and September 2000 was to conduct a ground search of the area to verify whether the probability of finding rattlesnake hibernacula could be determined through the use of these techniques.

Nicholson and Rose (2001) suggested that remote sensing techniques could be used to minimize ground searches by identifying areas that need not be searched. However, hibernacula were found within areas ranked as having low probability, suggesting that the remote sensing technique is not totally accurate. Re-classification of probabilities after ground searching suggests that the remote sensing technique may exaggerate the number of high probability ratings. This is due to specific limiting factors and micro-site conditions affecting the rattlesnake that are not evident solely from remote sensing analysis. The mapped areas of differing probabilities often followed landforms and other topographical features, making it quite easy to locate the different regions of probability on the ground. Stratification did facilitate a more organized ground search.

Nicholson and Rose (2001) described the characteristics of den sites that were located in their study. Parameters included aspect, landform, location, terrain, and presence of vegetation. Occurrences of prairie rattlesnake (live and road-killed) and other snake species were documented along with incidental sightings of other threatened or rare wildlife.

Dinosaur Provincial Park (Ed Hofman 2000, Alberta Fish and Wildlife Division)

Ed Hofman (Alberta Fish and Wildlife Division) has been collecting and analyzing rattlesnake data within the protected area of Dinosaur Provincial Park. By using microchip marking and radio telemetry tracking, data were obtained on general life history information for prairie rattlesnakes and specific biophysical features of their habitat. Since the start of this project in 1997, 82 prairie rattlesnakes and 23 bullsnakes have been implanted with PIT tags. Snakes that are recaptured are processed for data on physical parameters, sex, population information and other aspects of snake ecology. Radio transmitters have also been used to track daily and

seasonal movements of rattlesnakes, in order to gain general life history information and locations of hibernacula (E. Hofman, pers. comm.).

Brooks Area (Corry Moes, 2000 Alberta Fish and Wildlife Division)

The Alberta Fish and Wildlife Division has collected data on active and inactive hibernacula along the Red Deer River drainage system (from Brooks to Saskatchewan). Corry Moes collected data during the summer and fall of 2000 on the prairie rattlesnake and other rare species. Problems were encountered when trying to amalgamate all of the hibernaculum site occurrences from available historical data. Many hibernacula were found to be inactive, possibly not verified for a long period of time, and many dens were replicated in the data set (with different descriptions for each entry). Moes suggests that the entire historical database should be updated and all sites verified (active or non-active). A final report will be prepared that summarizes the work completed on the Red Deer River drainage. Moes believes that there are many other active hibernacula in the area that have not yet been located. Future work may include a PIT tagging project at the Kennedy Coulee hibernaculum.

Suffield National Wildlife Area (Andy Didiuk, 1999, Canadian Wildlife Service)

Andrew Didiuk of the Canadian Wildlife Service continues to monitor prairie rattlesnakes on the Canadian Forces Base Suffield (A. Didiuk, pers. comm.). As part of a wildlife inventory for the National Wildlife Area, a Reptile and Amphibian Component Report was released in 1999. The report summarizes work completed during 1994, 1995 and 1996. The inventory has generated new information regarding the prairie rattlesnake and will be important in developing management plans for the area, as well as other regions of the Canadian prairie (Didiuk 1999).

This study included the development of criteria to assess habitat for potential snake hibernacula. Hibernaculum characteristics, including limiting factors, are also described. Data on numbers, sex, reproductive status and distribution were obtained from snakes caught in the study area at drift fences and hibernacula. Radio telemetry was used to obtain data on seasonal and daily movements and habitat use.

Human-related influences within the protected area were evaluated, and management suggestions were made regarding grazing, oil and gas exploration, and military training exercises. Road mortality rates were high; 65 mortalities were found on one particular stretch of road over the three-year period. Mortality rates are possibly underestimated because dead snakes may be difficult to detect in some locations and scavengers remove some road-killed snakes.

City of Lethbridge Inventories (Reg Ernst, 1998)

The City of Lethbridge initiated a two-year project in 1997 to gain information on local prairie rattlesnake hibernacula and populations. Ernst (1998) collected data on spring egress, fall ingress, behaviour and estimates of snake populations. Ernst (1998) suggested that the rattlesnake populations in the Lethbridge area are small and that continued development in the area threatens some of the known hibernacula. This particular project ended because of a lack of funding, however, a management proposal has been submitted to the city and awaits approval (R. Ernst, pers. comm).

List of Titles in This Series
(as of January 2002)

No. 1 Alberta species at risk program and projects 2000-2001, by Alberta Sustainable Resource Development, Fish and Wildlife Division. (2001)

No. 2 Survey of the peregrine falcon (*Falco peregrinus anatum*) in Alberta, by R. Corrigan. (2001)

No. 3 Distribution and relative abundance of the shortjaw cisco (*Coregonus zenithicus*) in Alberta, by M. Steinhilber and L. Rhude. (2001)

No. 4 Survey of the bats of central and northwestern Alberta, by M.J. Vonhof and D. Hobson. (2001)

No. 5 2000 survey of the Trumpeter Swan (*Cygnus buccinator*) in Alberta, by M.L. James and A. James. (2001)

No. 6 2000/2001 Brassy Minnow inventory at Musreau Lake and outlet, by T. Ripley. (2001)

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